

2021

Jotul V602 V2

ASTM 3053 TESTING
KELLI O'BRIEN CLEARSTAK

Address | City, St Zip Code

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AFFADAVIT

ClearStak was contracted by the Northeast States for Coordinated Air Use Management (NESCAUM) to provide testing services for the Jotul V602 V2 Wood-Fired Room Heater per ASTM E3053, *Standard Test Method for Determining Particulate Matter Emissions from Wood Heaters Using Cordwood Test Fuel*, which was approved for use under EPA ALT-125.

All testing and associated procedures were conducted at ClearStak Laboratory beginning on 3/17/2021 and ending on 3/17/21. ClearStak's Laboratory is located at 99 Canal Street, Putnam, CT.

Testing procedures followed ASTM E3053, with variances as described in EPA ALT-125. Particulate sampling was performed per ASTM E2515, *Standard Test Method for Determination of Particulate Matter Emissions Collected by a Dilution Tunnel*, with the exception of caveats described in EPA ALT-125. A copy of EPA ALT-125 is included in

ClearStak has been approved by the U.S. Environmental Protection Agency to conduct certification and auditing of wood heaters pursuant to subpart AAA of 40 CFR Part 60, New Source Performance Standards for Residential Wood Heaters and subpart QQQQ of 40 CFR Part 60, Standards of Performance for New Hydronic Heaters and Forced Air Furnaces, Methods 28R, 28WHH, 28 WHH-PTS, and all methods listed in Sections 60.534 and 60.5476. ClearStak holds EPA Accreditation Certificate Number X. ClearStak is accredited by IAS to ISO 17020:2012 "Criteria for Bodies Performing Inspections," and ISO 17025:2005 "Requirements for Testing Laboratories." ClearStak is also accredited by the Standards Council of Canada to ISO 17065:2012 "Requirements for Bodies Operating Product Certification Systems."

Commented [LR1]: Is this correct?

The following people were associated with the testing, analysis and report writing associated with this project:

- Kelli O'Brian
- Brian Vinal
- ????

Authorized Signature

Date

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INTRODUCTION

NESCAUM of Boston, MA contracted with ClearStak to perform testing on Jotul F602 V2 Wood-Fired Room Heater. All testing was performed at ClearStak's Laboratory located in Putnam, CT. All testing was performed by x.

Background

- Testing was conducted using ASTM 3053 pre Alt 125. Two tests were completed.
 - One test used the instructions provided to the laboratory for certification testing
 - One test used the instructions contained in the Owner's Manual downloaded from the manufacturers' website on March 16, 2021.
- Prior to the start of testing, 50 hours of conditioning was performed by HLS Laboratory
- Prior to the start of testing, the dilution tunnel was cleaned with a steel brush.
- Front filters were changed on sample train A at one hour for all 3 test runs.

Appliance Specifications

- Appliance Tested: F602 V2
- Serial Number: XXXX
- Manufacturer: Jotul
- Catalyst: No
- Heat exchange blower: Optional
- Type: Cordwood Stove – variable air settings
- Style: Freestanding
- Date Received: XXXX
- Test Method: ASTM 3053:18
- Test Fuel Species: Oak
- Testing Period – Start: XXXXX
- Testing Period – End: XXXXXX
- Test Location: ClearStak Laboratory
99 Canal Street, Putnam, CT
- Elevation: ~x feet above sea level
- Test Technician(s): XXXXXXXXXXXXXXXX, XXXXXXXXXXXXXXXX
- Observers: XXXXXXXXXXXXXXXX, XXXXXXXXXXXXXXXX

TEST PROCEDURES AND EQUIPMENT

TEST PROCEDURE

Sampling procedures were completed by X, x and X
Analytical procedures were performed by x, x, and x.

All procedures followed ASTM E3053-18 and ASTM E2515-17. The table below summarizes the equipment used for testing. Appendix X contains calibration data for this Equipment.

TEST EQUIPMENT

The following table lists the equipment used in testing and summary calibration data. Detailed data on calibration can be found in Appendix X.

Table [SEQ Table * ARABIC]. Testing Equipment Data

Equipment ID#	Equipment Description	Calibration Data
	Floor Scale	
	Platform Scale	
	Fuel Scale	

TEST CONDITIONS SUMMARY

APPLIANCE DESCRIPTION

Appliance Manufacturer: Jotul
Wood Stove Model: F602V2
Type: Freestanding

WOOD HEATER INFORMATION

Materials of Construction: The unit is constructed primarily of cast iron.

The firebox is lined with fire brick that measures X x X x X" thick. The feed door measures X" x X", no glass panel, and x" gasket.

Air Introduction System:

- *Primary air:* Enters the appliance from the bottom through an air wash above the door.
- *Secondary air:* Enters from the bottom of the stove through the back and sides, into three stainless tubes with holes.
- *Pilot air:* Not applicable.
- *Other controls:* Not applicable.

Combustion Control Mechanisms: All control mechanisms are manually controlled.

Combustor: N/A.

Internal Baffles: Stepped baffle secondary combustion technology located above the secondary air tubes mounted in the top of the firebox.

Other Features: An optional fan is located near the bottom of the back of the appliance.

Flue Outlet: The 6" diameter flue outlet is in the top of the unit near the rear of the firebox.

Loading direction: north/south

Appliance weight:

Exterior Dimensions:

Similar Models: the F602V2 is unique to the Jotul wood heater product line.

Firebox Dimensions

The Jotul F602 certification test report states that the firebox dimensions were:

- 8.5"(W) X 16" (D) X 8.5-10" (H)

Clearstak staff measured the appliance and obtained measurements, as detailed in Table 2. Firebox dimensions and volumes (Matched, not matched) what was in the certification test report.

Table [SEQ Table * ARABIC]. Firebox Measurement

Dimension	Measurement (")
Length	X
Width	X
Height	X
Excluded Areas: basis for exclusion	X

Firebox Volume Calculations

The certification test reported a firebox volume was calculated as 0.817 cubic feet. Based on the data obtained at Clearstak, a firebox volume of X was calculated. For testing purposes the firebox volume used in the certification test was used for this test to ensure comparable results.

APPLIANCE OPERATION

Appliance settings

Testing with owner's manual instructions				
Run #	Procedures	Primary Air Setting	Secondary Air Setting	Other settings
1.1	Fuel loading time: X seconds			
	Door:			
	Fan			
	Fuel Adjustments			
	Other			
1.2	Fuel loading time: X seconds			
	Door:			
	Fan			
	Fuel Adjustments			
	Other			
2.1	Fuel loading time: X seconds			
	Door:			
	Fan			
	Fuel Adjustments			
	Other			
2.1	Fuel loading time: X seconds			
	Door:			
	Fan			
	Fuel Adjustments			
	Other			
2.2	Fuel loading time: X seconds			
	Door:			
	Fan			
	Fuel Adjustments			
	Other			

Additional runs, if needed

	Fuel loading time: X seconds			
	Door:			
	Fan			
	Fuel Adjustments			
	Other			
	Fuel loading time: X seconds			
	Door:			
	Fan			
	Fuel Adjustments			
	Other			

Testing with Manu to Lab instructions				
Run #	Procedures	Primary Air Setting	Secondary Air Setting	Other settings
3.1	Fuel loading time: X seconds			
	Door:			
	Fan			
	Fuel Adjustments			
	Other			
3.2	Fuel loading time: X seconds			
	Door:			
	Fan			
	Fuel Adjustments			
	Other			
4.1	Fuel loading time: X seconds			
	Door:			
	Fan			
	Fuel Adjustments			
	Other			
4.2	Fuel loading time: X seconds			
	Door:			
	Fan			
	Fuel Adjustments			
	Other			
<i>Additional runs, if needed</i>				
	Fuel loading time: X seconds			
	Door:			
	Fan			
	Fuel Adjustments			
	Other			
	Fuel loading time: X seconds			
	Door:			

	Fan			
	Fuel Adjustments			
	Other			

TEST FUEL PROPERTIES

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SUMMARY TABLES

Table / SEQ Table * ARABIC /. Model Identification

Model Name/number	F602 V2
Manufacturer	Jotul
Manufacturer address	55 Hutcheson Dr.; Gorham, ME; 04038
Appliance category	Cordwood stove
Usable Firebox Volume	0.817
Catalytic	No
Convection Air Fan	No

Table / SEQ Table * ARABIC /. Laboratory Information

Testing Lab	Clearstak
Address	99 Canal Street; Putnam, CT
ISO Accreditation info	XXXXX
Testing dates	XXXXX
Test Method	ASTM 3053-18/Alt 125
Dilution Tunnel Inside Diameter in inches	XXXXX
Filter diameter	47 mm
Filter material	XXXXX

Table / SEQ Table * ARABIC /. Summary Results – Testing with Owners Manual Instructions

Date	Run #	Run Category	Burn Rate	PM (g/hr)	PM 1hr (g/hr)	PM (g/kg)	CO (g/kg)	CO (g/mn)	HHV Eff (%)
	1.1								
	1.2								
	2.1								
	2.2								
Weighted Avg – PM (g/hr)									

Highest first hour PM (g/hr)	
Weighted Avg – efficiency	
Avg CO (g/min)	

Table { SEQ Table * ARABIC }. Summary Results -- Testing with Manufacturer Instructions to Certification Lab

Date	Run #	Run Category	Burn Rate	PM (g/hr)	PM 1hr (g/hr)	PM (g/kg)	CO (g/kg)	CO (g/min)	HHV Eff (%)
	3.1								
	3.2								
	4.1								
	4.2								
Weighted Avg – PM (g/hr)									
Highest first hour PM (g/hr)									
Weighted Avg – efficiency									
Avg CO (g/min)									

Table { SEQ Table * ARABIC }. Test Facility Conditions

Run #	Room Temperature		Barometric Pressure		Relative Humidity		Air Velocity	
	Before	After	Before	After	Before	After	Before	After
	F	F	In Hg	In Hg	%	%	Ft/min	Ft/min
Testing according to owner's manual								
1.1								
1.2								
2.1								
2.2								

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<i>Testing according to lab instructions</i>								
3.1								
3.2								
4.1								
4.2								

Table [SEQ Table * ARABIC]. Dilution Tunnel Flow Measurements and Sampling Data

Avg dilution tunnel measurements					Sample data			
Run#	Burn time	Volumetric Flow Rate	Max Temp	Max Rh	Volume sampled (DSCF)		Total PM (g)	
	min	Dscf/min	F	%	Train 1	Train 2	Train 1	Train 2
<i>Testing according to owner's manual</i>								
1.1								
1.2								
2.1								
2.2								
<i>Testing according to lab instructions</i>								
3.1								
3.2								
4.1								
4.2								

Table / SEQ Table * ARABIC /. Dilution Tunnel Dual Train Precision

Run#	Sample Ratio		Total Emissions (g)		% Deviation
	Train 1	Train 2	Train 1	Train 2	
Testing according to owner’s manual					
1.1					
1.2					
2.1					
2.2					
Testing according to lab instructions					
3.1					
3.2					
4.1					
4.2					

TEST RUN NARRATIVE

Testing According to Owner's Manual Instructions

Run 1.1

Run 1.1 was performed on xx/xx/xxxx as a start-up/high fire test run per ASTM 3053. Emissions sampling began from a cold start ignition at (insert time). It took x seconds to load the fuel. Air settings were at x, and remained there for the entire test run. The door remained open (describe opening – fully open, x inches cracked, etc) for x minutes. The start-up period lasted x minutes. The high fire fuel load was loaded into the stove at x minutes into the test run. The fuel was loaded in x seconds. The door remained open for x minutes. The high fire phase lasted x minutes, when 90% of the test fuel load had been consumed. Describe any fuel adjustments made during the test run.

Table / SEQ Table * ARABIC /. Run 1.1 Data Table

Reporting Element	Findings
Any deviations from proportionality requirements	
Any filter temperature exceedances	
Any negative filter weights	
Maximum relative humidity measurement	
Maximum tunnel temperature	
Any anomalies during testing	

Run 1.2

Run 1.2 was performed on xx/xx/xxxx as a low-fire test run per ASTM 3053, x minutes after the end of test run 1.1. Emissions sampling began when the at (insert time). It took x seconds to load the fuel. Air settings were at x, describe any changes to air setting after so many minutes air settings moved to fully closed. The door remained open (describe opening – fully open, x inches cracked, etc) for x minutes and was fully closed x minutes into the test. The low fire phase lasted x minutes, when 100% of the test fuel load had been consumed. Describe any fuel adjustments made during the test run.

Table [SEQ Table * ARABIC]. Run 1.2 Data Table

Reporting Element	Findings
Any deviations from proportionality requirements	
Any filter temperature exceedances	
Any negative filter weights	
Maximum relative humidity measurement	
Maximum tunnel temperature	
Any anomalies during testing	

Run 2.1

Run 2.1 was performed on xx/xx/xxxx as a start-up/high fire test run per ASTM 3053. Emissions sampling began from a cold start ignition at (insert time). It took x seconds to load the fuel. Air settings were at x, and remained there for the entire test run. The door remained open (describe opening – fully open, x inches cracked, etc) for x minutes. The start-up period lasted x minutes. The high fire fuel load was loaded into the stove at x minutes into the test run. The fuel was loaded in x seconds. The door remained open for x minutes. The high fire phase lasted x minutes, when 90% of the test fuel load had

Table [SEQ Table * ARABIC]. Run 2.1 Data Table

Reporting Element	Findings
Any deviations from proportionality requirements	
Any filter temperature exceedances	
Any negative filter weights	
Maximum relative humidity measurement	
Maximum tunnel temperature	
Any anomalies during testing	

Run 2.2

Run 2.2 was performed on xx/xx/xxxx as a medium-fire test run per ASTM 3053, x minutes after the end of test run 2.1. Emissions sampling began when the at (insert time). It took x seconds to load the fuel. Air settings were at x, describe any changes to air setting after so many minutes air settings moved to fully closed. The door remained open (describe opening – fully open, x inches cracked, etc) for x minutes and was fully closed x minutes into the test. The low fire phase lasted x minutes, when 100% of the test fuel load had been consumed. Describe any fuel adjustments made during the test run.

Table / SEQ Table * ARABIC /. Run 2.2 Data Table

Reporting Element	Findings
Any deviations from proportionality requirements	
Any filter temperature exceedances	
Any negative filter weights	
Maximum relative humidity measurement	
Maximum tunnel temperature	
Any anomalies during testing	

Testing According to Lab Instructions

Run 3.1

Run 3.1 was performed on xx/xx/xxxx as a start-up/high fire test run per ASTM 3053. Emissions sampling began from a cold start ignition at (insert time). It took x seconds to load the fuel. Air settings were at x, and remained there for the entire test run. The door remained open (describe opening – fully open, x inches cracked, etc) for x minutes. The start-up period lasted x minutes. The high fire fuel load was loaded into the stove at x minutes into the test run. The fuel was loaded in x seconds. The door remained open for x minutes. The high fire phase lasted x minutes, when 90% of the test fuel load had been consumed. Describe any fuel adjustments made during the test run.

Table / SEQ Table * ARABIC /. Run 3.1 Data Table

Reporting Element	Findings
Any deviations from proportionality requirements	
Any filter temperature exceedances	
Any negative filter weights	
Maximum relative humidity measurement	
Maximum tunnel temperature	
Any anomalies during testing	

Run 3.2

Run 3.2 was performed on xx/xx/xxxx as a low-fire test run per ASTM 3053, x minutes after the end of test run 3.1. Emissions sampling began when the at (insert time). It took x seconds to load the fuel. Air settings were at x, describe any changes to air setting after so many minutes air settings moved to fully closed. The door remained open (describe opening – fully open, x inches cracked, etc) for x minutes and was fully closed x minutes into the test. The low fire phase lasted x minutes, when 100% of the test fuel load had been consumed. Describe any fuel adjustments made during the test run.

Table { SEQ Table * ARABIC }. Run 3.2 Data Table

Reporting Element	Findings
Any deviations from proportionality requirements	
Any filter temperature exceedances	
Any negative filter weights	
Maximum relative humidity measurement	
Maximum tunnel temperature	
Any anomalies during testing	

Run 4.1

Run 4.1 was performed on xx/xx/xxxx as a start-up/high fire test run per ASTM 3053. Emissions sampling began from a cold start ignition at (insert time). It took x seconds to load the fuel. Air settings were at x, and remained there for the entire test run. The door remained open (describe opening – fully open, x inches cracked, etc) for x minutes. The start-up period lasted x minutes. The high fire fuel load was loaded into the stove at x minutes into the test run. The fuel was loaded in x seconds. The door remained open for x minutes. The high fire phase lasted x minutes, when 90% of the test fuel load had been consumed. Describe any fuel adjustments made during the test run.

Table [SEQ Table * ARABIC]. Run 4.1 Data Table

Reporting Element	Findings
Any deviations from proportionality requirements	
Any filter temperature exceedances	
Any negative filter weights	
Maximum relative humidity measurement	
Maximum tunnel temperature	
Any anomalies during testing	

Run 4.2

Run 2.2 was performed on xx/xx/xxxx as a medium-fire test run per ASTM 3053, x minutes after the end of test run 1.1. Emissions sampling began when the at (insert time). It took x seconds to load the fuel. Air settings were at x, describe any changes to air setting after so many minutes air settings moved to fully closed. The door remained open (describe opening – fully open, x inches cracked, etc) for x minutes and was fully closed x minutes into the test. The low fire phase lasted x minutes, when 100% of the test fuel load had been consumed. Describe any fuel adjustments made during the test run.

*Table / SEQ Table * ARABIC /. Run 4.2 Data Table*

Reporting Element	Findings
Any deviations from proportionality requirements	
Any filter temperature exceedances	
Any negative filter weights	
Maximum relative humidity measurement	
Maximum tunnel temperature	
Any anomalies during testing	

SAMPLING

Sampling Methods

The Jotul F602V2 wood stove was tested in accordance with the U.S. EPA 40 CFR Part 60, Subpart AAA – Standards of Performance for New Residential Wood Heaters using EPA Alt-125 and ASTM E2515. Particulate emissions were measured using sampling trains consisting of two filters (front and back). The appliance was tested for thermal efficiency and carbon monoxide (CO) emissions in accordance with CSA B415.1-10.

Sampling Locations

Sample ports are located X feet downstream from any disturbances and X foot upstream from any disturbances. Flow rate traverse data was collected X feet downstream from any disturbances and X feet upstream from any disturbances.

Table [SEQ Table * ARABIC]. Dilution Tunnel Gas Measurements and Sampling Data

Run	Length of Test (min)	Average Dilution Tunnel Gas Measurements		
		Velocity (ft/sec)	Flow Rate (dcsf/min)	(F)
1.1				
1.2				
2.1				
2.2				
3.1				
3.2				
4.1				
4.2				

*Figure [SEQ Figure * ARABIC]. Dilution Tunnel Photo with Stove on the Stand*

Insert picture of stove on the stand note sampling locations

*Figure [SEQ Figure * ARABIC]. Dilution Tunnel Schematic*

Insert schematic of dilution tunnel with measurements

INSTRUCTIONS

Owner's Manual instructions
Laboratory Operating Instructions

Required Photographs per ASTM 3053

General Photographs

*Figure [SEQ Figure * ARABIC]. Complete test installation – venting*

Insert photo

*Figure [SEQ Figure * ARABIC]. Complete test installation – front view*

Insert photo

*Figure [SEQ Figure * ARABIC]. Complete test installation – rear view*

Insert photo

*Figure [SEQ Figure * ARABIC]. Complete test installation – side view*

Insert photo

Run 1.1

*Figure [SEQ Figure * ARABIC]. Test fuel load before it is placed in the firebox*

Insert photo

*Figure [SEQ Figure * ARABIC]. Kindling/start-up fuel configuration placed in the firebox*

Insert photo

*Figure [SEQ Figure * ARABIC]. Residual start-up fuel bed before and after any adjustments*

Insert photo

*Figure [SEQ Figure * ARABIC]. Photograph or video of residual fuel bed*

Insert photo

Run 1.2

*Figure [SEQ Figure * ARABIC]. Test fuel load before it is placed in the firebox*

Insert photo

*Figure [SEQ Figure * ARABIC]. Test fuel load after it is placed in the firebox*

Insert photo

*Figure [SEQ Figure * ARABIC]. Residual start-up fuel bed before and after any adjustments*

Insert photo

*Figure [SEQ Figure * ARABIC]. Photograph or video of residual fuel bed*

Insert photo

Run 2.1

*Figure [SEQ Figure * ARABIC]. Test fuel load before it is placed in the firebox*

Insert photo

*Figure [SEQ Figure * ARABIC]. Kindling/start-up fuel configuration placed in the firebox*

Insert photo

*Figure [SEQ Figure * ARABIC]. Residual start-up fuel bed before and after any adjustments*

Insert photo

*Figure [SEQ Figure * ARABIC]. Photograph or video of residual fuel bed*

Insert photo

Run 2.2

*Figure [SEQ Figure * ARABIC]. Test fuel load before it is placed in the firebox*

Insert photo

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Insert photo

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Insert photo

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Insert photo

Run 3.1

*Figure [SEQ Figure * ARABIC]. Test fuel load before it is placed in the firebox*

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Insert photo

*Figure [SEQ Figure * ARABIC]. Residual start-up fuel bed before and after any adjustments*

Insert photo

*Figure [SEQ Figure * ARABIC]. Photograph or video of residual fuel bed*

Insert photo

Run 3.2

*Figure [SEQ Figure * ARABIC]. Test fuel load before it is placed in the firebox*

Insert photo

*Figure [SEQ Figure * ARABIC]. Test fuel load after it is placed in the firebox*

Insert photo

*Figure [SEQ Figure * ARABIC]. Residual start-up fuel bed before and after any adjustments*

Insert photo

*Figure [SEQ Figure * ARABIC]. Photograph or video of residual fuel bed*

Insert photo

Run 4.1

*Figure [SEQ Figure * ARABIC]. Test fuel load before it is placed in the firebox*

Insert photo

*Figure [SEQ Figure * ARABIC]. Kindling/start-up fuel configuration in the firebox*

Insert photo

*Figure [SEQ Figure * ARABIC]. Residual start-up fuel bed before and after any adjustments*

Insert photo

*Figure [SEQ Figure * ARABIC]. Photograph or video of residual fuel bed*

Insert photo

Run 4.2

*Figure [SEQ Figure * ARABIC]. Test fuel load before it is placed in the firebox*

Insert photo

*Figure [SEQ Figure * ARABIC]. Test fuel load after it is placed in the firebox*

Insert photo

*Figure [SEQ Figure * ARABIC]. Residual start-up fuel bed before and after any adjustments*

Insert photo

*Figure [SEQ Figure * ARABIC]. Photograph or video of residual fuel bed*

Insert photo

APPENDIX A: TEST DATA SUMMARY

Table [SEQ Table * ARABIC], Test Condition Summary

Model Name(s) / number(s)	F 602 V2			
Usable firebox Volume-ft3	0,817			
Convection Air Fan (No, Standard, Optional)	NO			
Test runs #	1,1	1,2	2,1	2,2

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M_rep_EPAwoodstove ALT-125 V1 -- May 15th 2018



St-Jean-sur-Richelieu, January 25th 2019

Client: Jonel

Project: PI-20183

Model: F602 V2

Date tested	07-012019	07-012019	08-012019	08-012019
test run category (L,M,H)	H	L	H	M
average barometric pressure - in Hg	30,37	30,37	29,72	29,72
Max observe Ambient temp. °F	80,13	78,20	77,32	81,70
Min observe Ambient Temp °F	72,57	73,04	72,68	75,72
Max observe Filter temp °F	89,12	88,32	89,37	86,09
Run air settings				
Primary (measured up from minimum)	full open	full closed	full open	medium setting
Secondary (measured up from minimum)	fix	fix	fix	fix
Convection air setting	none	none	none	none
Test fuel load				
Cordwood fuel species	Oak	Oak	Oak	Oak
specific Gravity (from Table 1)	0,66	0,66	0,66	0,66
Higher heating value - Btu/lb (from Annex A1)	8690	8690	8690	8690
Nom. Test fuel piece length - in	14	14	14	14
Number of test fuel pieces	4	5	4	5
Test fuel Weight				
Kindling - as fired lb.	1,30	NA	1,20	NA
Kindling Wt. - as % of test fuel load	16,3%	NA	14,6%	NA
Kindling Moisture % Db	9,0	NA	9,0	NA
Kindling Kg DB	0,54	NA	0,50	NA
SU Fuel Wt- as fired lb	2,00	NA	2,00	NA
SU Fuel wt. - as % of test fuel load	25,1%	NA	24,3%	NA
SU Fuel moisture - % DB	20,0	NA	20,0	NA
SU fuel- Kg DB	0,76	NA	0,76	NA
Test Fuel Load - As Fired lb	7,98	9,50	8,22	9,78
Ave. Test Fuel Load MC % DB	21,52	20,93	21,12	21,06
Test Fuel Load - kg DB	2,98	3,56	3,08	3,66

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Test Fuel Load - kg Db	4,98	3,56	3,48	3,56
Test fuel Loading density lb./ft3	9,98	11,88	10,27	12,20
Residual SU fuel wt. - as fired lb.	1	NA	1	NA
Residual SU fuel wt. - as % of test fuel load	12,5%	NA	12,2%	NA
Test run duration - minutes	58	192	50	159
Test run duration - h	0,97	3,20	0,83	2,65
Test fuel load wt at the end of the test - as fired lb	0,8	0	0,77	0



St-Jean-sur-Richelieu, January 25th 2019

Client: Jotul

Project: P-20183

Model: F802 V2

total fuel burned kg Db	3,46	3,56	3,53	3,66
% test fuel load wt at end of the test	10,0%	0,0%	9,4%	0,0%

3.4 - Test Results Summary

Table [SEQ Table * ARABIC], Test Results Summary

Table [SEQ Table * ARABIC] Weighted Average Summary

Model name / number	F 602 V2			
Usable Firebox volume	0,817			
Convection air Fan (no, Standard, option)	NO			
Test runs nu.	1,1	1,2	2,1	2,2
Date tested	07-01-2019	07-01-2019	08-01-2019	08-01-2019
Test run category	H	L	H	M
Burn rate - Kg/hr DB	3,65	1,11	3,99	1,38
Burn rate as % of low to high Midpoint	NA	30,5%	NA	34,6%
Burn duration - h	0,97	3,20	1	3
Heat output btu/hr	46 466	15 200	52 685	18 506
Average Dilution Tunnel Flow Rate - dscfm	319,1	347,3	316,8	336,9
Average Sample Flow Rates - dscfm				
Train 1	0,1358	0,1338	0,1352	0,1332
Train 2	0,1324	0,1303	0,1313	0,1295
Total PM Emissions - g				
Train 1 g	4,15	3,55	2,50	6,50
Train 2 g	4,26	3,12	2,82	5,90
Average	4,21	3,33	2,66	6,20
PM emission train precision %	1,29%	6,54%	5,97%	4,78%
PM emission g/kg	1,22	0,94	0,75	1,69
PM emission rate g/h	4,35	1,04	3,19	2,34
Total Co Emission g	37,8	181,8	51,6	239,6
Co emission Rate g/h	54,0	56,8	75,4	90,4
1 st hour emission rate g/h	4,2	2,6	2,6	4,6
Overall Efficiency - CSA B415,1				
% HHV Basis	67,26%	71,18%	66,80%	69,88%
% LHV Basis	72,37%	76,59%	71,68%	75,19%

Table [SEQ Table * ARABIC]. Weighted Average Summary

Model name / number	F 602 V2
Usable Firebox volume	0,817
Convection air Fan (no, Standard, option)	NO

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M_fap_EFAwoodstove ALT-125 V1 – May 2017



St-Jean-sur-Richelieu, Jan

Pr

average for each test run category	L	M	H
burn rate kg/h DB	1,11	1,38	3,82
PM Emission rate - g/h	1,04	2,34	3,77
Co emission rate - g/h	56,82	90,40	64,73
Overall Efficiency - CSA B 415,1			
% HHV Basis	71,2%	69,9%	67,0%
% LHV Basis	76,6%	75,2%	72,1%
Heat output - Btu/hr	15200	18506	49576
Category weighting	0,4	0,4	0,2

Table [SEQ Table * ARABIC], Weighted Average Final Results

ASTM E 3053 Weighted averages			
PM Emission Rate - g/h	2,11		
CO Emission Rate g/h	71,8		
Overall Efficiency - CSA B415,1			
% HHV Basis	69,83%		
% LHV Basis	75,14%		
Heat output range - Btu/h	15 200	to	49576
Co Arithmetic average g/min	1,18		

[PAGE * MERGEFORMAT]

APPENDIX B: RUN 1.1 DATA

RUN CALCULATIONS

Weight of test fuel load, dry basis, lb(kg)
Weight of start-up fuel, dry basis, lb (kg)
Weight of kindling, dry basis, lb (kg)
Total weight of fuel burned during test run, lb (kg), dry basis
Dry Burn Rate lb/hr (kg/hr)
Average gas velocity in the dilution tunnel, ft/sec)
Average gas flow rate in dilution tunnel, dscf/hr
Volume of gas sampled, corrected to dry standard and conditions,
dscf
Total particulate matter collected, mg
Concentration of particulate matter in tunnel gas, dry basis,
corrected to STP, g/dscf
Total particulate emissions, g
Proportional rate variation
Particulate emission rate for the run, g/hr
Particulate emission rate for the first hour, g/hr
Particulate emission factor, g/dry kg of fuel burned
Efficiency

LAB NOTES

RAW DATA

Fuel data
Filter Weights
Filter Temperatures
Proportionality Results

Relative Humidity Measurements

APPENDIX C: RUN 1.2 DATA

RUN CALCULATIONS

Weight of test fuel load, dry basis, lb(kg)
Total weight of fuel burned during test run, lb (kg), dry basis
Dry Burn Rate lb/hr (kg/hr)
Average gas velocity in the dilution tunnel, ft/sec)
Average gas flow rate in dilution tunnel, dscf/hr
Volume of gas sampled, corrected to dry standard and conditions,
dscf
Total particulate matter collected, mg
Concentration of particulate matter in tunnel gas, dry basis,
corrected to STP, g/dscf
Total particulate emissions, g
Proportional rate variation
Particulate emission rate for the run, g/hr
Particulate emission rate for the first hour, g/hr
Particulate emission factor, g/dry kg of fuel burned
Efficiency

LAB NOTES

RAW DATA

Fuel data
Filter Weights
Filter Temperatures
Proportionality Results
Relative Humidity Measurements

APPENDIX C: RUN 2.1 DATA

RUN CALCULATIONS

Weight of test fuel load, dry basis, lb(kg)
Weight of start-up fuel, dry basis, lb (kg)
Weight of kindling, dry basis, lb (kg)
Total weight of fuel burned during test run, lb (kg), dry basis
Dry Burn Rate lb/hr (kg/hr)
Average gas velocity in the dilution tunnel, ft/sec)
Average gas flow rate in dilution tunnel, dscf/hr
Volume of gas sampled, corrected to dry standard and conditions,
dscf
Total particulate matter collected, mg
Concentration of particulate matter in tunnel gas, dry basis,
corrected to STP, g/dscf
Total particulate emissions, g
Proportional rate variation
Particulate emission rate for the run, g/hr
Particulate emission rate for the first hour, g/hr
Particulate emission factor, g/dry kg of fuel burned
Efficiency

LAB NOTES

RAW DATA

Fuel data
Filter Weights
Filter Temperatures
Proportionality Results
Relative Humidity Measurements

APPENDIX D: RUN 2.2 DATA

RUN CALCULATIONS

Weight of test fuel load, dry basis, lb(kg)
Total weight of fuel burned during test run, lb (kg), dry basis
Dry Burn Rate lb/hr (kg/hr)
Average gas velocity in the dilution tunnel, ft/sec)
Average gas flow rate in dilution tunnel, dscf/hr
Volume of gas sampled, corrected to dry standard and conditions,
dscf
Total particulate matter collected, mg
Concentration of particulate matter in tunnel gas, dry basis,
corrected to STP, g/dscf
Total particulate emissions, g
Proportional rate variation
Particulate emission rate for the run, g/hr
Particulate emission rate for the first hour, g/hr
Particulate emission factor, g/dry kg of fuel burned
Efficiency

LAB NOTES

RAW DATA

Fuel data
Filter Weights
Filter Temperatures
Proportionality Results
Relative Humidity Measurements

APPENDIX E: RUN 3.1 DATA

RUN CALCULATIONS

Weight of test fuel load, dry basis, lb(kg)
Weight of start-up fuel, dry basis, lb (kg)
Weight of kindling, dry basis, lb (kg)
Total weight of fuel burned during test run, lb (kg), dry basis
Dry Burn Rate lb/hr (kg/hr)
Average gas velocity in the dilution tunnel, ft/sec)
Average gas flow rate in dilution tunnel, dscf/hr
Volume of gas sampled, corrected to dry standard and conditions,
dscf
Total particulate matter collected, mg
Concentration of particulate matter in tunnel gas, dry basis,
corrected to STP, g/dscf
Total particulate emissions, g
Proportional rate variation
Particulate emission rate for the run, g/hr
Particulate emission rate for the first hour, g/hr
Particulate emission factor, g/dry kg of fuel burned
Efficiency

LAB NOTES

RAW DATA

Fuel data
Filter Weights
Filter Temperatures
Proportionality Results
Relative Humidity Measurements

APPENDIX F: RUN 3.2 DATA

RUN CALCULATIONS

Weight of test fuel load, dry basis, lb(kg)
Total weight of fuel burned during test run, lb (kg), dry basis
Dry Burn Rate lb/hr (kg/hr)
Average gas velocity in the dilution tunnel, ft/sec)
Average gas flow rate in dilution tunnel, dscf/hr
Volume of gas sampled, corrected to dry standard and conditions,
dscf
Total particulate matter collected, mg
Concentration of particulate matter in tunnel gas, dry basis,
corrected to STP, g/dscf
Total particulate emissions, g
Proportional rate variation
Particulate emission rate for the run, g/hr
Particulate emission rate for the first hour, g/hr
Particulate emission factor, g/dry kg of fuel burned
Efficiency

LAB NOTES

RAW DATA

Fuel data
Filter Weights
Filter Temperatures
Proportionality Results
Relative Humidity Measurements

APPENDIX G: RUN 4.1 DATA

RUN CALCULATIONS

Weight of test fuel load, dry basis, lb(kg)
Weight of start-up fuel, dry basis, lb (kg)
Weight of kindling, dry basis, lb (kg)
Total weight of fuel burned during test run, lb (kg), dry basis
Dry Burn Rate lb/hr (kg/hr)
Average gas velocity in the dilution tunnel, ft/sec)
Average gas flow rate in dilution tunnel, dscf/hr
Volume of gas sampled, corrected to dry standard and conditions,
dscf
Total particulate matter collected, mg
Concentration of particulate matter in tunnel gas, dry basis,
corrected to STP, g/dscf
Total particulate emissions, g
Proportional rate variation
Particulate emission rate for the run, g/hr
Particulate emission rate for the first hour, g/hr
Particulate emission factor, g/dry kg of fuel burned
Efficiency

LAB NOTES

RAW DATA

Fuel data
Filter Weights
Filter Temperatures
Proportionality Results
Relative Humidity Measurements

APPENDIX H: RUN 4.2 DATA

RUN CALCULATIONS

Weight of test fuel load, dry basis, lb(kg)
Total weight of fuel burned during test run, lb (kg), dry basis
Dry Burn Rate lb/hr (kg/hr)
Average gas velocity in the dilution tunnel, ft/sec)
Average gas flow rate in dilution tunnel, dscf/hr
Volume of gas sampled, corrected to dry standard and conditions,
dscf
Total particulate matter collected, mg
Concentration of particulate matter in tunnel gas, dry basis,
corrected to STP, g/dscf
Total particulate emissions, g
Proportional rate variation
Particulate emission rate for the run, g/hr
Particulate emission rate for the first hour, g/hr
Particulate emission factor, g/dry kg of fuel burned
Efficiency

LAB NOTES

RAW DATA

Fuel data
Filter Weights
Filter Temperatures
Proportionality Results
Relative Humidity Measurements

QUALITY ASSURANCE/QUALITY CONTROL

SAMPLE ANALYSIS
CALIBRATIONS
CALCULATIONS
ALT-125 LETTER

ANALYTICAL METHODS DESCRIPTION
CALIBRATION, QUALITY CONTROL AND
ASSURANCES